AIR INJECTION/SOIL VAPOR EXTRACTION/AIR SPARGING DESIGN REPORT

AT THE GRANVILLE SOLVENTS SITE GRANVILLE, OHIO

Submitted to

The United States Environmental Protection Agency
Emergency Response Branch
Region V
Chicago, Illinois 60673

February, 2001

Developed for the

Granville Solvents PRP Group
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February 22, 2001

Mr. Kevin Adler
Remedial Project Coordinator
U.S. Environmental Protection Agency, Region 5
Office of Superfund, Remedial & Enforcement Response Branch
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Subject: **Granville Solvents Site Removal Action**
Final Air Injection/Soil Vapor Extraction/Sparging Design Report
Revised Pages

Dear Mr. Adler:

On behalf of the Granville Solvents Site PRP Group, Metcalf & Eddy, Inc. respectfully submits revised text for the Final Air Injection/Soil Vapor Extraction/Sparging Design Report. Changes have been made to address concerns and comments provided by you and the Ohio EPA on Friday, February 9, 2001.

If you have questions, please contact Mr. Michael Raimonde or me at (614) 890-5501.

Respectfully,

METCALF & EDDY OF OHIO, INC.

Gerald R. Myers
Vice President/Project Coordinator

cc: Fred Myers, Ohio EPA, DERR, Central District
B. Pfefferle, Chairman - GSS PRP Group
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January 17, 2001

Mr. Kevin Adler, Remedial Project Coordinator
U.S. Environmental Protection Agency, Region 5
Office of Superfund, Remedial & Enforcement Response Branch
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Subject: **Granville Solvents Site Removal Action**
Air Injection/Soil Vapor Extraction/Sparging Design Report

Dear Mr. Adler:

On behalf of the Granville Solvents Site PRP Group, Metcalf & Eddy, Inc. respectfully submits the Air Injection/Soil Vapor Extraction/Sparging Design Report for your consideration. The engineering design sheets are provided under separate cover.

We would appreciate the opportunity in the next two weeks to discuss questions that you may have regarding this report. In the meantime, if you have questions, please contact Mr. Michael Raimonde or me at (614) 890-5501.

Respectfully,

METCALF & EDDY OF OHIO, INC.

Gerald R. Myers (gp)

Gerald R. Myers
Vice President/Project Coordinator

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EXECUTIVE SUMMARY

Granville Solvents, Inc. is a former solvent blending and recycling facility located on a 1.5-acre parcel in the Village of Granville, Ohio. The parcel is located within the hydraulic influence of the Village of Granville well field that is located 700 feet to the west of the facility. Groundwater and soil beneath the site contain volatile organic compounds. An Administrative Order on Consent (1994), between the U.S. EPA and a group of potentially responsible parties at the Granville Solvents Site, requires the completion of certain Removal Actions. These include requirements to install a groundwater pump and treat system, to reinstate the capacity of the wellfield, and to treat impacted soils to reduce levels of contaminants so that no groundwater beneath the soils will become contaminated above No Further Action Levels. A groundwater pump and treat system was installed in 1994. A new production well was installed in the Village wellfield in 1997.

An Engineering Evaluation/Cost Analysis (EE/CA) issued in August 1999 addressed soil treatment requirements for volatile organic compounds based on data collected regarding the distribution of contaminants in soil and groundwater. It is apparent from that analysis that soils will need to be treated to certain criteria or soil treatment goals to assure that groundwater beneath the soils will not become contaminated above the No Further Action Levels. Soil treatment goals were established using numerical modeling and risk assessment methods. Only two compounds detected in the soil, trichloroethene (TCE, 6.67 mg/Kg) and perchloroethene (PCE, 5.53 mg/Kg), exceed soil treatment goals.

Soil vapor extraction was the EE/CA selected remedial technique to address soils beneath the Site. Several site investigations identified a fine-grained soil from the ground surface to a depth of 20 feet. Pneumatic fracturing was proposed to enhance the air permeability of the soil. A pilot test was conducted to evaluate the site-specific performance of soil vapor extraction and the effect of pneumatic fracturing. The lithology in the pilot test area consists of 7 to 12 feet of clay-

rich material (clay unit) underlain by sand and gravel (sand unit). The sand unit extends below the groundwater table approximately 20 feet below ground surface in the area of the pilot test.

The pilot test consisted of soil vapor extraction, pneumatic fracturing, and pressurized air injection tests in the clay unit and soil vapor extraction tests in the underlying sand unit. Results indicated that airflow rates from the unaltered clay unit were 25 to 33 scfm at a vacuum of 10 to 12.5 inches of Hg and that no significant increase of flow rate occurred following fracturing. The radius of influence of 18 feet remained similar in all tests.

Pressurized air injection tests were conducted to compare the relative performance with soil vapor extraction. Air injection rates were equivalent to air extraction rates achieved in the soil vapor extraction tests. However, this flow rate was obtained using 48 percent less pressure (70 inches of water versus 136 inches of water).

Tests in the sand and gravel beneath the clay resulted in airflow rates of 120 standard cubic feet per minute (scfm). During the test two sand unit wells were operated within this unit and the radius of influence extended beyond the area impacted with chemicals of concern at concentrations above soil treatment goals. Vacuum pressure during the test averaged 12 inches of water.

The concentration of total volatile organic compounds extracted from the upper layer as measured using a photoionization detector (PID) during the long-term clay unit test steadily increased. At the end of the test, the concentration was 25 ppmV while at a flow rate of 70 scfm. This represents a removal rate of approximately 0.9 pounds per day. After operating the sand unit test for 30 days, the concentration of volatile organic compounds measured using a PID was 70 ppmV with a flow rate of 125 scfm. This represents a removal rate of approximately 4.3 pounds per day with a declining trend.

Conclusions drawn from the pilot test are:

- The clay unit beneath the site is seven to 12 feet thick where measured in the test area.
- Soil vapor extraction in the clay unit, without pneumatic fracturing, is feasible.
- Pneumatic fracturing resulted in no significant increase in airflow rates over those obtained under natural conditions in the clay unit.
- The test did not provide evidence that pneumatic fracturing will increase the radius of effective influence of the soil vapor extraction system in the clay unit.
- The test did not provide evidence that pneumatic fracturing will quantitatively increase the rate of mass removal from the clay unit.
- Air injection in the clay unit is feasible at a rate of injection similar to air extraction using SVE.
- An unsaturated sand unit is present beneath the impacted area of the site and beneath the clay unit.
- Soil vapor extraction is feasible in the sand unit.

Based on the results of the pilot test and data available from past investigations, a conceptual design for the remediation system was developed. The system shall consist of three interdependent elements. These elements include an air injection system in the clay unit, a soil vapor extraction system in the sand unit, and an air sparging system in the saturated sand unit. These systems will be employed on the site in the areas impacted with the chemicals of concern at concentrations above the soil treatment goals.

The objective of the system is to reduce the concentrations of the chemicals of concern in the soils to concentrations below established treatment goals. The results of the pilot test provide the basis for design of the Soil Removal Action. Air injection wells in the clay unit and soil vapor extraction (SVE) wells in the sand unit shall be used to reduce the concentration of the chemicals of concern to concentrations below soil treatment goals. The data collected from the operation of the clay unit wells during the SVE tests and the air injection test provide the basis of design of

the air injection wells in the clay unit. The data collected from the operation of the sand unit SVE wells during the pilot test provide the basis of design of the SVE wells in the sand unit.

Data collected during past investigations indicate the presence of chemicals of concern in the aquifer matrix. This chemical mass, like the chemical mass in the unsaturated zone, serves as a continuing source of dissolved chemicals to the plume of impacted groundwater. Over time, the concentration of these chemicals will be reduced. Until the concentration of chemicals of concern is sufficiently reduced, the plume of impacted groundwater will be contained by the pump and treat system.

Air sparging is a feasible means to remove chemical mass from the aquifer matrix. By injecting air below the water table in the impacted area, chemicals of concern will be stripped and transferred to the overlying unsaturated zone and collected by the SVE system operating in that unit. The basis of design for the air sparging system is professional judgement and past experience with similar site conditions.

The Removal Action system will be operated in a manner to limit the emission rate to less than ten pounds per day. Air emission testing will be conducted on a periodic basis to document emissions. In addition, these data will be used to document the progress of the Removal Action.

When appropriate, the GSS PRP Group will undertake certain actions to determine the progress of the Removal Action. These actions may include the analysis of soil and emission data and other operating data. Based on the results of such analysis, soil samples will be collected to determine if the soil treatment goals have been achieved. The details of the means and methods to determine the completion of the Removal Action will be submitted to the U.S. EPA and Ohio EPA for consideration as the first task of the implementation of the Soil Removal Action.

Section One

1. BACKGROUND

The Administrative Order on Consent (AOC, 1994) between the U.S. EPA and a group of Potentially Responsible Parties (PRPs) at the Granville Solvents Site (GSS PRP Group) requires the completion of certain Removal Actions at the Granville Solvents Site (Site). These Removal Actions include the installation of a pump and treat system to halt migration of groundwater contamination toward the Village of Granville municipal wellfield; reinstatement of the capacity of the Village of Granville production well (PW-1); and treatment of soils to levels so that no groundwater beneath the soils will become contaminated above the groundwater No Further Action Levels. Although the U.S. EPA Regional Project Manager (RPM), pursuant to CERCLA, has the authority to halt, conduct, or direct any work required and undertaken by the GSS PRP Group at the site, the PRP Group has conducted significant work. The GSS PRP Group installed, and is operating, a groundwater pump and treat system and has provided a new production well for the Village of Granville.

Data have been collected in previous investigations to characterize soil and groundwater conditions (M&E, 1995a-d and 1996a-f). The results of these investigations indicate that chlorinated and non-chlorinated volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) have been detected at the Site. These data have been evaluated, and the extent and distribution of contaminants in the soil and groundwater have been defined. The compounds in the soil are primarily located in the vicinity of the warehouse building.

The *Engineering Evaluation/Cost Analysis* (EE/CA; M&E, 1999) addressed the soil treatment requirements of the AOC. Within this document, a detailed analysis of the Site conditions was presented. This analysis determined that to comply with the requirements of the AOC and the Action Memorandum (U.S. EPA, 2000), it will be necessary to treat soil to the treatment criteria listed in Table 1. Two compounds, trichloroethylene (TCE) and tetrachloroethylene (PCE), have

been detected in site soils in excess of the soil treatment goals. The soil treatment goals for these compounds are 5.53 mg/kg for PCE and 6.67 mg/kg for TCE.

TABLE 1

RISK-BASED SOIL TREATMENT GOALS

Chemicals of Concern	Maximum Concentration Detected in Soil (mg/kg)	Risk-Based Soil Treatment Goal* (mg/kg)
1,1,1-trichloroethane	1.7	147.81
1,1,2-trichloroethane	0.012	4
1,1-dichloroethane	0.011	59.22
1,1-dichloroethene	0.007	0.0274
cis-1,2-dichloroethene	4.6	48.85
Trans-1,2-dichloroethene	0.021	94.74
2-butanone	0.014	360
Acetone	0.084	139
Benzene	0.014	3
Carbon disulfide	0.7	4
Chlorobenzene	0.027	66
Chloroform	0.002	62
Ethylbenzene	3.6	320.59
Methylene chloride	0.002	1.6
Tetrachloroethene	18	5.53
Toluene	0.34	725.20
Trichloroethene	11	6.67
Vinyl chloride	0.03	0.44
Xylenes (total)	44	907.00

* Risk-based soil treatment goals established in EE/CA (1999).

Five alternatives were identified in the EE/CA (1999) as potential Removal Actions that would reduce the concentrations of PCE and TCE in the soil to below soil treatment goals. Each alternative was evaluated based on the NCP criteria and the Superfund Accelerated Cleanup Model (SACM) guidance. The properties of the chemicals of concern are similar, allowing all of the chemicals of concern to be addressed using one technology. The results of this evaluation

indicated that soil vapor extraction (SVE) with pneumatic fracturing, as necessary, would be an appropriate and cost effective action.

The U.S. EPA published an Action Memorandum dated March 8, 2000, which was received by the Granville Solvents PRP Group on March 15, 2000, that recommended soil vapor extraction and pneumatic fracturing as an enhancement.

Although pneumatic fracturing-enhanced soil vapor extraction has been used successfully at many sites throughout the Country, its site-specific performance had to be evaluated to verify that the site conditions are compatible with the technology. Pursuant to this site-specific evaluation, a *Pneumatic Fracturing/Soil Vapor Extraction Pilot Test Work Plan* (Work Plan) (M&E, 2000a) was submitted on April 14, 2000, and approved by the U.S. EPA on April 21, 2000.

The pneumatic fracturing/soil vapor extraction pilot test commenced on April 27, 2000. During the pilot test, several modifications were made to accommodate unexpected field conditions. An addendum to the Work Plan (M&E, 2000b) describing the required modifications was submitted to the U.S. EPA on May 25, 2000.

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Section Two

2.0 SITE CONDITIONS

The Site is the location of an inactive waste solvent blending and recycling operation at 300 Palmer Lane in Granville, Licking County, Ohio (Figure 1). It is located within the Village of Granville's southern corporate limit and approximately one-third of a mile southwest of downtown Granville. The Site is a 1.5-acre triangular-shaped parcel located adjacent to a residential area, with some commercial and light-industrial business nearby. Palmer Lane is the northwest site boundary. A former railroad track, now a bike and walking path, is the southern border of the Site with the Cherry Street overpass bordering the Site on the east. Raccoon Creek is located approximately 100 feet south of the walking and bike path. The Village of Granville municipal well field is located 700 feet west and downgradient of the Site. The Site is zoned for commercial use.

2.1 SUBSURFACE CONDITIONS

The Site is situated on alluvial terrace deposits at the northern edge of Raccoon Creek Valley. It is directly underlain by clay-, silt- and sand-rich sediments deposited on the Raccoon Creek floodplain. Below the surface soil material is a highly permeable sand and gravel outwash. The finer-grained surface materials may retard but do not form a hydraulic barrier to the infiltration of precipitation from the surface. A typical vertical lithologic section expected beneath the site, based on lithologic logs from drilling, is a low permeability clay unit which is predominantly clay, but consists of interbedded fine-grained sand, silt, and clay lenses extending from the ground surface down to a depth ranging from 6 feet bgs to 20 feet bgs (Figures 2-6). The clay unit is underlain by a sand unit which consists of interbedded fine-to-coarse-grained sand, gravel, and clay lenses.

The thickness of this low-permeability unit in the area of the pilot test and the area under which soil treatment criteria are exceeded is 7 to 12 feet. Extending beneath the water table, the aquifer

consists chiefly of fine- to coarse-grained sand and silt, interbedded with gravel lenses of various thicknesses and appears to be a continuation of the sand unit described above.

2.2 EXTENT OF IMPACTED SOIL

Based on the soil conditions encountered during the pilot test and data collected during previous investigations, the aerial extent of chemicals at concentrations above soil treatment goals in the clay and sand units are displayed on Figure 7.

Section Three

3.0 PERFORMANCE OBJECTIVES

3.1 SOIL TREATMENT GOALS

Risk-Based Soil Treatment Goals (Table 1) were established in the Engineering Evaluation/ Cost Analysis (M&E, 1999) based on the protection of groundwater and potential future excavation workers and industrial employees. The objective of the Soil Removal Action is to reduce the concentration of the chemicals of concern to or below the soil treatment goals in contaminated soils.

Chemicals of Concern	Maximum Concentration Detected in Soil (mg/kg)	Risk-Based Soil Treatment Goal* (mg/kg)
1,1,1-trichloroethane	1.7	147.81
1,1,2-trichloroethane	0.012	4
1,1-dichloroethane	0.011	59.22
1,1-dichloroethene	0.007	0.0274
cis-1,2-dichloroethene	4.6	48.85
Trans-1,2-dichloroethene	0.021	94.74
2-butanone	0.014	360
Acetone	0.084	139
Benzene	0.014	3
Carbon disulfide	0.7	4
Chlorobenzene	0.027	66
Chloroform	0.002	62
Ethylbenzene	3.6	320.59
Methylene chloride	0.002	1.6
Tetrachloroethene	18	5.53
Toluene	0.34	725.20
Trichloroethene	11	6.67
Vinyl chloride	0.03	0.44
Xylenes (total)	44	907.00

* Risk-based soil treatment goals established in EE/CA (1999).

3.2 CONCEPTUAL SYSTEM DESIGN

The system shall consist of three interdependent elements. These elements include an air injection system in the clay unit, a soil vapor extraction system in the sand unit, and an air sparging system in the saturated sand unit. These systems shall be employed on the site in the areas impacted with the chemicals of concern at concentrations above the soil treatment goals.

Air shall be injected into the clay unit to strip the chemicals of concern from the unit. As the air passes through the clay, these chemicals will partition into the air. The air will travel into the underlying sand unit and to the surface. A soil vapor extraction system will be installed in the sand unit to serve two purposes. This system will remove chemicals of concern that are present in this unit and collect the air that has been injected into the clay unit and migrated to the sand unit. As a complement to this system, vapor extraction wells will be installed at the surface covered with an impermeable barrier to collect the air that is injected into the clay unit and migrates to the surface.

There are chemicals of concern in the saturated soil below the water table at concentrations that exceed the no further action levels. Because the overlying sand unit is of high permeability, an opportunity exists to remove some chemical mass from the soils below the water table by injecting air into this zone to strip these chemicals from below the water table. Those chemicals removed by this sparging will be collected by the SVE system in the sand unit.

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Section Four

4.0 BASIS FOR DESIGN

4.1 AIR INJECTION SYSTEM IN THE CLAY UNIT

The design flow rate for each air injection well will be 25 scfm to produce a radius of influence of 12.5 feet. This design is intended to provide for additional capacity and overlap of areas of influence to account for uncertainty of the properties of the clay unit in areas not tested. Fourteen wells will be installed to provide adequate coverage over the area containing chemicals of concern at concentrations above soil treatment goals. Two wells used in the pilot test will also be incorporated into the final system. A single positive displacement blower, capable of supplying 400 scfm air flow at 100 inches of water column pressure, will be used to supply the pressure and air to this system.

4.2 SOIL VAPOR EXTRACTION SYSTEM IN THE SAND UNIT

Soil vapor extraction (SVE) wells in the sand unit will be used to reduce the concentration of the chemicals of concern to soil treatment goals or below in that unit. The SVE system will also be used to collect the air that is injected in the clay unit that moves to the sand unit and to the surface. In addition, the air injected below the water table that moves to the overlying sand unit will be collected by the SVE system. The data collected during the operation of the sand unit SVE wells during the pilot test and professional judgement provide the basis of design of the SVE wells in the sand unit.

Five vacuum extraction wells will be installed in the sand unit. The design flow rate for each well is 100 scfm. The air injected into the clay unit, as described above, will move through the clay into the underlying sand unit and be collected in the five vacuum extraction wells located in the sand unit and the air that moves to the surface will be collected in seven horizontal vapor extraction wells above the surface covered with an impermeable barrier. The design flow rate for the horizontal vapor extraction wells is 25 scfm. Two regenerative blowers that are capable

of providing 350 scfm each at 20 inches of water column vacuum will be used to provide the vacuum and airflow for this system. The capacity of the SVE system is capable of collecting all air injected into the ground with additional capacity to reduce the concentration of the chemicals of concern in the sand unit.

4.3 AIR SPARGING SYSTEM

Data collected during past investigations indicate the presence of chemicals of concern in the aquifer matrix. This chemical mass, like the chemical mass in the unsaturated zone, serves as a continuing source of dissolved chemicals to the plume of impacted groundwater. Over time, the concentration of these chemicals will be reduced. Until the concentration of chemicals is sufficiently reduced, the plume of impacted groundwater will be contained by the pump and treat system.

Air sparging is a feasible means to remove chemical mass from the aquifer matrix. By injecting air below the water table in the impacted area, chemicals of concern will be stripped and transferred to the overlying unsaturated zone and collected by the SVE system operating in that unit. The basis of design for the air sparging system is professional judgement and past experience with similar site conditions.

The design flow rate for each sparging well is 30 scfm. Six sparging wells will be installed at the site beneath the area where the sand unit contains chemicals of concern at concentrations above the soil treatment goals. A single positive displacement blower capable of supplying 100 scfm at 18 psi shall be used to supply air to this system. The six wells will be operated in a pulsed mode with air injection by only three of the six wells at any one time.

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Section Five

5.0 OPERATION, MAINTENANCE, AND MONITORING SCHEDULE

Following installation, periodic inspections will be conducted to verify that the system is operating and to check the major equipment. The frequency of inspection is listed in Table 2. Vacuum, pressure, and airflow rates will be monitored. Air emission testing will be conducted using two methods. A photoionization detector (PID) will be used routinely to measure the relative concentration of volatile concentrations in the off gas of the system. Gas samples will also be collected and analyzed using standard methods TO-14/TO-15 on a periodic basis and to validate PID measurements. A discussion of the relative accuracy of the methods and the application is provided in Appendix C. The system equipment will be maintained in accordance with the manufacturer's specifications and as required based on inspections.

The system will be operated in a manner to limit the emissions to a rate less than 10 pounds per day consistent with the appropriate Ohio EPA regulations (OAC 3745-31) for *de minimus* exemption. This will be accomplished by progressively adding the engineered components of the system starting with the sand unit SVE system, progressively adding the air injection system for the clay unit, and finally adding the sparge system. The system emissions shall be monitored periodically to confirm that emission limits are not exceeded.

It is anticipated that the sand unit will generate an emission rate of less than 4.5 pounds per day at startup. A single sample of off-gas was collected and analyzed using methods TO-14/TO-15 during the sand unit test in June, 2000 (Appendix C). At that time the PID reading recorded was 75 ppmV while the system was operating at a rate of 125 scfm (5.09×10^6 L/day). Based on the TO-14/TO-15 analysis and using a surrogate of 1,1,1-TCA at a concentration of 24.9 ppmV (134 mg/cubic meter), an estimate of the emission rate is 1.5 pounds per day.

$$\mathbf{5.09 \times 10^6\ L/day \times 10^{-3}\ m^3/L \times 0.134\ gm_{\ 1,1,1TCA}\ /m^3 \times 1/453.6\ gm/lb = 1.5\ lb/day}$$

At start-up, the SVE system in the sand unit will be operated at a rate of approximately 350 scfm, or three times the rate when the sample described above was sampled.

TABLE 2

OPERATION, MAINTENANCE, AND MONITORING SCHEDULE

	Start-up Period (2 weeks)	**First Quarter**	**Long Term**
Operation Check	Daily	Weekly	Monthly
Equipment Inspect	Daily	Weekly	Monthly
Vacuum, Pressure and Flow Rate Monitoring	Daily	Weekly	Monthly
Emission Testing (PID)	Daily*	Weekly*	Monthly*
Emission Sampling and Analysis (TO-14/TO-15)	At Start	Monthly	Quarterly
Equipment Maintenance	As Specified by Equipment Manufacturers and Based on Equipment Inspection		

* Air monitoring along the fence line will be conducted coincident with emission testing. Four locations will be monitored along the fence line corresponding to the four compass directions.

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Section Six

6.0 STRATEGY FOR DISCONTINUING OPERATION OF THE SOIL TREATMENT SYSTEM

TCE and PCE have both been detected at concentrations in excess of the respective soil treatment goals of 6.67 and 5.53 mg/Kg. Based on current data, an estimate of the mass of TCE and PCE in the soil in the area requiring treatment is 85 and 110 pounds, respectively. Since estimates of contaminant mass are complicated by several factors, additional data will be collected during the installation of the treatment wells.

Soil samples will be collected throughout the depth of the borings during the installation of each treatment well. For borings completed in the clay unit, two samples will be submitted for chemical analysis to determine the concentrations of VOCS of concern. One of these samples will be collected from a depth immediately above the interface between the clay unit and the sand unit and the second at a depth exhibiting the highest concentration using a PID measurement. From borings that extend into the sand unit, one additional sample collected immediately above the water table will be submitted for analysis. For borings that extend below the water table, one additional sample will be collected from a depth exhibiting the highest concentration determined with field instrumentation. The results of the analysis will be used to estimate the mass of contaminants in the treatment zone.

As specified in Section 5 of this design report, gas samples will be collected periodically to determine VOC emission rates of the treatment system (monthly PID and quarterly TO-14). The concentration of total VOCs will be used to estimate the cumulative mass removed. The estimated cumulative mass removed will be compared to the mass needed to achieve concentrations of TCE and PCE below their respective soil treatment goals. The trend of VOCs removed over the operating time of the system will be evaluated. When it appears that sufficient mass has been removed and that the removal rates are stable, soil sampling will be conducted to verify that soil treatment goals have been met. The means and methods for soil sampling and

analysis will be submitted to the U.S. EPA for consideration as the first task of the soil remediation project.

Section Seven

7.0 PLANS AND SPECIFICATIONS

To maximize the effectiveness of the air injection system to be installed in the clay unit and the soil vapor extraction systems to be installed in the sand unit, the warehouse building overlying a significant portion of the contaminated area will be removed. Specifications for the demolition and disposal of the concrete floor of the building are provided in Appendix A. Samples of the soil underlying the floor will be collected and analyzed to verify the location and extent of air injection and soil vapor extraction wells needed in that area. The means and methods for this sampling and analysis will be submitted to the U.S. EPA for consideration following slab removal.

Specifications for the blowers and PLC are provided in Appendix B and drilling specifications are provided in Appendix C. Plans and Specifications are also provided in Attachment 1- Air Injection, Soil Vapor Extraction, and Air Sparging Design Drawings. These drawings are incorporated herein by this reference.

8

Section Eight

8.0 REFERENCES

Metcalf & Eddy, Inc. 1995a. Aquifer Pumping Test Report for the Granville Solvents Site in Granville, Ohio; for the Granville Solvents Site PRP Group.

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Metcalf & Eddy, Inc. 2000c. Soil Vapor Extraction/Pneumatic Fracturing Pilot Test Report; for the Granville Solvents Site, Granville, Ohio; for the Granville Solvents PRP Group.

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U.S. EPA. 1994. Administrative Order by Consent Pursuant to Section 106 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as Amended, 42 U.S.C.S. 9606(a) in the Matter of Granville Solvents Site; September 7, 1994.

U.S. EPA, 2000. Enforcement Action Memorandum, United States Environmental Protection Agency, Region V, March 8, 2000.

APPENDIX A

BUILDING DEMOLITION SPECIFICATIONS

SCOPE OF WORK

1.0 GENERAL

The Contractor shall furnish all labor, materials, tools and equipment, adequate and qualified supervision, all utilities, incidentals and demolition services required for the completion of the work of this project. All work shall be executed in conformance with the scope of work, specifications, and conditions.

M&E shall schedule one (1) pre-bid site visit at the Granville Solvents facility. The purpose of this visit is to allow the bidder to become familiar with the work locations and the items which may affect the work described in this bid document.

The facility is currently involved in a CERCLA action. The site contains three structures to be demolished. They include a warehouse structure, an office structure and a still structure. Each structure including all floors and foundations shall be demolished and placed into containers provided by others.

The contractor shall be responsible for erosion control resulting from all activities in accordance with the Erosion Control Plan to be provided.

2.0 DEMOLITION

2.1 Introduction

This section covers the requirements for the demolition and disposal of three buildings at the Granville Solvents site as required for site clearing. It is intended that one firm, hereinafter referred to as the Contractor, shall be fully responsible for the performance of all of the work required by and described in this document. The division of work within this document, irrespective of the locations and of the description of work and methods, is not intended to limit

responsibilities of the Contractor or to provide bid documents for subcontractors, but only to provide a ready reference.

Contractor shall furnish all labor, tools, equipment, material, supplies and supervision for the dismantlement and demolition of the structures to containers provided.

Contractor shall be responsible for obtaining all permits necessary for the completion of the work. The contractor shall adhere to local ordinances, including building and noise ordinances, and adjust the work schedule accordingly.

It shall be not be the responsibility of the Contractor to coordinate transportation and disposal subcontractors. M&E will not accept costs from the Contractor due to claims arising from the performance of subcontractors, lack of coordination, interference of the work of one subcontractor with that of another or other such internal problems of the Contractor.

The demolition work shall be planned and executed in a manner to cause negligible interference with the ongoing site activities including work of other contractors. Contractor shall obtain clearance from the M&E Field Representative before the start of any work, which will interfere with site operations and services.

Contractor shall be responsible for having a competent person perform an engineering survey prior to demolition, in compliance with the O.S.H.A. standard at 29 CFR 1926.850. Contractor shall provide M&E a copy of a site-specific Health & Safety Plan two weeks prior to commencement of the work. This Plan shall be reviewed only for the purpose of determining compliance with the contract. Contractor shall be required to review the M&E site specific Health & Safety Plan and agree to comply with the limitations therein during execution of the work.

Standards and codes referenced herein shall be construed to mean the latest editions of such standards and codes including all revisions thereto as of date of proposal and latest addenda.

It is not the intent of this document to fix the method to be used by the Contractor nor to provide the information needed by the Contractor to prepare the quotation and perform the work. Contractor shall submit with the bid a preliminary sequence of work schedule. The successful Bidder shall submit, within one (1) week of contract signing, a detailed schedule giving approval, procedures and bar chart of demolition activities. Procedures shall comply with federal, state, and local regulations and be reviewed by M&E prior to demolition.

If any unforeseen condition arises not specifically covered by this document, final agreement shall be resolved between M&E in writing before any work is undertaken. Any change in the scope of the project because of conflicting statements and/or drawings must be submitted to the Contractor in writing before work is initiated.

The Contractor shall submit a lump sum price to perform all the work required for the demolition, as described in this document.

All quoted prices shall include any detailing, procurement, equipment, materials, supplies, labor, shipping, permits and licenses, documentation, record maintenance, physical, premium time payment, competent and experienced supervision, clerical and field help, all tools and construction equipment, and all applicable taxes, insurance, inspection fees, all overhead and profit required for the complete job.

Further it is intended that any equipment, materials or services not specifically described in this document, but which may be necessary to complete the work for the use intended or in the manner as described shall be within the Contractor's scope of work and included in the quoted prices.

No explosives are to be used in performing this scope of work.

Contractor shall be responsible for reporting to Ohio EPA, plans for demolition in accordance with NESHAPS asbestos regulation at 40 CFR 61.145.

2.2 Scope Of Work

2.2.1 General

1. The work shall be performed by the Contractor at the Granville Solvents site, under a lump sum Contract.

2. The Contractor shall furnish all labor, tools, equipment, materials, supplies and supervision for demolition of the building structure, floor slabs and foundations, as called for herein.

3. Contractor shall submit with their bid a preliminary bar chart schedule. The successful Bidder shall prepare a detailed sequence of work schedule, within one (1) week of contract signing, detailing approach, procedures and bar chart of demolition activities. All sequences of work shall be reviewed by M&E well in advance of the execution of work. Procedures proposed by Contractor shall comply with federal, state, and local regulations.

4. The demolition work by the Contractor shall include, but not be limited to, buildings, roofing, siding, walls, structural steel, brick, masonry, piping, electrical/control systems, conduits, as may be required to meet the contract's intent.

5. Controlled burning of combustibles on-site shall not be permitted.

2.2.2 Structural and Miscellaneous Steel

1. The Contractor shall furnish equipment, labor materials, tools and supervision to dismantle, and place in containers, all structural and miscellaneous steelwork within contract limits. No cutting of any painted material with heat producing or friction wheel devices is permitted. Materials shall be placed into containers to minimize air

space. Steel shall be separated from non-steel materials, i.e. wooden purlins and wind bracing.

2. The Contractor shall dismantle and demolish the structure within the contract limits to the respective structure's pre construction grade elevation.

2.2.3 Concrete Slabs and Foundations.

1. Contractor shall demolish all building floors and slabs including any brick, block or poured concrete walls and/or columns. All debris shall be cut or crushed to limit the largest particle size to two-feet by two-feet by two-feet (2 x 2 x 2 feet).

2.2.4 Soil and Slab support Ballast

1. Soil and or slab ballast materials found below the floor slab of the warehouse structure may, at the option of M&E, be excavated to an additional depth of eighteen (18) inches. Please provide a separate, unit cost for this portion of the work. This soil will be placed directly into containers provided by M&E. This area is roughly 50 feet by 60 feet and is approximately 166 cubic yards of material, in-situ.

2.2.5 General Safety Precautions

1 The contractor shall keep the area clear of all personnel not directly involved with the demolition project. Contractor is responsible for checking the demolition site for possible unauthorized personnel prior to demolition.

2. Violation of the above policies shall be grounds for non-performance of the contract.

2.2.6 Electrical

The Contractor shall furnish equipment, labor, materials, tools and supervision to dismantle, remove and dispose of all aboveground electrical conduits, cables and services within contract limits attached to structures and equipment, designated to be scrap. Aboveground electrical conduits and cables, attached to common building walls/columns that establish contract limits, shall also be removed and disposed of provided the conduits and cables are located inside the buildings slated for demolition. All work shall be performed by the Contractor unless noted otherwise.

2.2.7 Disposal

1. M&E shall designate truck access routing in and out of the job site prior to the start of demolition.

2. Metcalf & Eddy shall make arrangements for hauling services for the disposal of demolition materials.

2.2.8 Protection of Existing Active Utility Lines

1. The Contractor shall, where applicable, erect protective covers to protect all existing active utility lines which shall not be demolished. Contractor will be held responsible for all damages that might be incurred due to negligence.

2. Contractor shall provide all necessary compressed air. M&E requires that Contractor use diesel powered air compressors if air compressors are necessary for the work.

3. Due to limited security at the job site, the Owner, M&E assumes no responsibility for Contractor's equipment and/or property while on-site due to theft, vandalism or other malicious behavior.

4. Contractor's employees shall not work on sheet and metal roofs or any type of roof unless walking on main purlins or structural steel below sheeting due to deteriorating conditions. Contractor to provide necessary safe means while working on any roof.

2.2.9 Contractor's Supervision

1. Contractor shall provide a complete field staff to properly supervise, control and schedule all demolition activities.

2. Contractor shall provide all offices, telephone service, and sanitary facilities necessary to support the field staff.

3. Contractor's field staff shall include a full-time Project Superintendent who shall be able to act on behalf of the Contractor on the site. Contractor shall designate a full-time Project Safety Supervisor other than the Project Superintendent to insure adherence and compliance to all safety regulations.

2.2.10 Labor, Equipment, Material and Workmanship

1. Contractor shall supply only qualified labor to perform quality workmanship for demolition.

2.2.11 Temporary Structures

1. Contractor shall furnish all necessary temporary buildings or trailers for field offices, storehouse, shops and craft tool sheds, chemical toilet facilities, electric and telephone services, or others as required for the proper execution of the work for the demolition force as required to perform the work and/or comply with federal, state and local codes.

2. Facilities provided by the Contractor for use during the execution of the work, such as, but not limited to, temporary buildings, shall remain the property of the Contractor and shall be disassembled and removed from the site upon completion of the work.

2.2.12 Receiving , Unloading and Loading of Demolition Equipment

1. Equipment and materials for use in demolition under this contract shall be received, unloaded, checked, inventoried and stored by the Contractor.

2. The Contractor shall provide a representative located at the site to receive, check and store any materials shipped. This representative must be at the site each day a shipment arrives.

2.2.13 Equipment Decontamination

1. All equipment shall be cleaned to the satisfaction of the M&E field representative at the contractor's expense prior to removal from the site.

2. All cleaning rinseate and sediment shall be contained by the use of a constructed decontamination pad suitable for the intended purpose.

2.2.14 Existing Operations

1. Contractor's personnel may be restricted from certain areas. The Contractor shall observe the restrictions imposed by M&E regarding passage of vehicles and personnel through controlled gates and passages, and shall enforce M&E's restrictions to maintain secure area.

2.2 15 Fire Protection and Dust Control

1. Contractor shall take precautionary measures to prevent fires, especially from cutting torch operations if employed. Contractor shall provide adequate, approved blankets to prevent sparks from starting fires or damaging Owner's buildings or equipment.

2 Contractor shall carefully supervise demolition operations and housekeeping to prevent fires.

3 If a demolition fire occurs, all equipment provided under this and other contracts shall be used effectively to control and extinguish the fire regardless of the cause, and all personnel at the demolition site shall be directed by the Contractors to assist in fighting the fire as appropriate. The Village of Granville, Fire Department shall be notified immediately and shall assume control, upon arrival, of all equipment and personnel, if necessary to extinguish blaze.

4. Contractor shall be aware that there are no operational fire hydrants within the contract limits. Contractor shall provide the necessary equipment to combat fire should the need arise.

5 Contractor must have a dust control plan in effect for all the demolition in this package; there are residential homes near the site. All complaints and damages due to dust or demolition will be the Contractor's responsibility.

2.3 Interferences

The Contractor will be required to cooperate with other Contractors in the general area, and if any differences of opinion arise between the Contractor and any others, the M&E Field Representative is empowered to decide on such differences.

3.0 DISPOSAL

The Contractor is not responsible for the transportation and disposal of all materials from the site All manifests will be created by and signed by an owner's representative. It is assumed that all materials, regardless of their individual characteristics are to be considered contaminated and subject to hazardous waste transportation and disposal. The contractor shall make every effort to contain and remove daily all miscellaneous trash generated by daily activities. M&E may chose to provide a suitable container for said municipal waste.

4.0 SITE GRADING

1. The site shall be graded with soils available following demolition activities. It is anticipated that some depression will result from the activities and these areas shall be graded so as to not restrict the surface water flow to the south at completion and to prevent ponding. Further treatment of the final surface condition of the excavated area may be required as appropriate when this portion of the project is complete.

5.0 SAFETY

1. The Contractor shall be required to follow all applicable health and safety regulations and shall be responsible for the safety and welfare of employees at all times.

2. The site at which the work will be performed is classified as a CERCLA hazardous waste site. As such, all Contractor employees will be required have valid 40-hour OSHA training in accordance with 29 CFR 1910.120.

3. The Contractor shall prepare and keep on-site a site-specific Health and Safety Plan (HASP) detailing health and safety provisions appropriate for all phases of

work to be performed. All Contractor employees and subcontractors who enter the job site shall read and sign the HASP prior to performing work.

4. While performing work in or on any building, the Contractor's employees shall follow all procedures as detailed in the Contractor's HASP.

5. Prior to commencing any work activities, the Contractor shall put in to place barricades, roping and warning signs to clearly identify the work zone and guard against unauthorized entry. OSHA construction regulations and standards shall be followed at all times. Contractor shall have a competent person perform an engineering survey prior to demolition as prescribed by OSHA standard 29 CFR 1926.850.

6. The Contractor shall take all precautions and measures to protect all employees and the general public from the physical hazards as a result of the work performed.

7. Contractor shall supply employees and subcontractor's employees with hard hats of an identifying color.

8. Contractor shall at all times exercise reasonable cautions for the safety of employees or other workmen in and around the work area. At no time is the Contractor permitted to knowingly place an employee in danger without proper protection and supervision.

9 Contractor shall be required to submit weekly reports on all accidents and submit to M&E and the Owner such documentation necessary to comply with all regulations.

10. Contractor shall immediately rectify all identified dangerous conditions that may exist, or be identified by regulatory agencies and/or M&E.

11. Contractor shall provide adequate temporary fire protection devices.

12. Contractor shall conduct regular safety inspections and daily safety meetings to insure compliance with all safety regulations.

13. Contractor shall erect and maintain suitable barricades, signs and/or lights at all hazardous areas to prevent injury to persons or damage to equipment.

6.0 PROPOSAL

Contractors' lump sum base bids shall include any detailing, procurement, equipment, materials, labor, premium time payment, competent and experienced supervision, clerical and field help, all tools and construction equipment, all applicable taxes, permits, insurance inspection fees, and all overhead and profit for completion of the scope of work defined in this document. Bid shall include all sales and use taxes for which the Contractor is responsible as the consumer of personal property.

All references to specifications, codes, standards and other documents given in this specification shall be construed to mean the latest editions of each as of the date of this specification. All conflicts between the various specifications and other bid information shall be brought to the attention of M&E for resolution prior to the submittal of the proposal.

If the Contractor recognizes any discrepancies in the detailed specification, these items shall be brought to the attention of M&E prior to the submittal of the proposal. All questions arising during bid preparation shall be written and transmitted via fax to M&E. The policy on correspondence shall be: A question by one is a question by all; an answer for one is an answer for all; response to all correspondence will be in the format of an amendment to all. M&E's fax number for this correspondence is (614) 890-7421 - Attention: Mark Andrew. No phone requests will be addressed by M&E. No Addendums will be issued later than 72 hours prior to bid opening.

BID SHEET

1.0	Mobilization to site	_____
2.0	Demolition of structures	_____
3.0	Demolition of foundations and Floor Slabs	_____
4.0	Site Grading	_____
5.0	Incidental Charges	_____
6.0	Decon Pad	_____ (Unit Cost)
7.0	Total Lump Sum Bid	_____
8.0	Standby Time Charges	_____ (Per Hour)
9.0	Excavation of Soils (166 Cubic Yards, Est)	_____

APPENDIX B

BLOWER AND PLC SPECIFICATIONS

APPENDIX B. BLOWER AND PLC SPECIFICATIONS

Air Sparging Blower

Positive displacement blower capable of supplying 100 scfm at 18 psi. The air temperature at the edge of the building must not exceed 180° F with an ambient temperature of 90° F. The blower should be sized near the middle of the operating curve.

Air Injection Blower

(Clay unit soils)

Positive displacement blower capable of supplying 400 scfm air flow at 100" w.c. pressure. Blower to be initially supplied with sheaves to provide 200 scfm flow at 80" w.c. near the lower end of the operating curve. A second set of sheaves and bolt to be supplied to allow operation at 400 scfm at 80" w.c. pressure. Air temperature at the edge of the building must not exceed 180° F with an ambient temperature of 90° F.

Vapor Extraction Blowers

Two (2) regenerative blowers of same make and model to each provide 350 scfm air flow at 20" w.c. vacuum. Both blowers to be supplied with building, connected to piping as shown in P&ID and other drawings. Only one of the blowers is to be initially wired for operation. The second blower wiring is to be stubbed to the appropriate location but not connected. Air temperature at blower discharge not to exceed 140° F at discharge location.

PLC Specification

Hand/Off/Auto (HOA) switches to be supplied for the following equiprnent (spring on hand switch):

VE-1	First vapor extraction blower	AS-V1	Air sparge actuator valve #1
VE-2	Second vapor extraction blower	AS-V2	Air sparge actuator valve #2
AI-1	Air injection blower	TP-1	Condensate transfer pump
AS-1	Air sparge blower	LSHH	High Level Alarm

On (green) and off (red) indicator lights to be supplied for the following equpment.

	Yellow Fail Lights		**Yellow Fail Lights**
VE-1	VE-1	AS-1	AS-1
VE-2	VE-2	AS-V1	AS-V1
AI-1	AI-1	AS-V2	AS-V2
		TP-1	TP-1

Start-up sequence:

VE-1 → AS-1 → AI-1

If VE-1 is not operating, AS-1 and AI-1 will not be permitted to operate.

ALARM CONDITIONS AND RESPONSE

CONDITION	RESPONSE
VE-1 Fail	1) If VE-2 is operating, and call for AI-1, light yellow VE-1 light and send common alarm. 2) If VE-2 is not operating - full system shut-down, light yellow VE-1 light and send common alarm.
VE-2 Fail	Same as VE-1 substituting VE-2 for VE-1.
AI-1 Fail	1) Light AI-1 yellow light 2) End call for AI-1 3) Send common alarm
AS-1 Fail	1) Light AS-1 yellow light 2) End call for AS-1 3) Send common alarm
AS-V1 Fail	1) Light AS-V1 yellow light 2) End call for AS-V1 3) Shut AS-1 down 4) Send common alarm
AS-V2 Fail	Same as for AS-V1 with AS-V2 substituted for AS-V1
TP-1 Fail	1) End call for TP-1 2) Light TP-1 yellow light 3) Send common alarm
T-1 LSHH	1) Full system shut-down except TP-1 2) Continue operation of TP-1 for 10 minutes then shut down. If LSHH is still present, send common alarm 3) If LSHH goes off, restart system
T-2 LSHH	1) Turn off TP-1 2) Send common alarm 3) Shut down system on next LSH activation for T-1

NOTES:

1) AS-V1 and AS-V2 controlled through PLC. Initially set to alternately open and close every four (4) hours. The time interval should be alterable by using a laptop with appropriate (supplied) software. Should be changeable from 1 minute to 1440 minutes by minute increments.

2) All common alarm conditions are sent to existing groundwater treatment plant PLC or auto dialer where they result in causing the auto dialer to call out and alert of an "SVE system common alarm".

APPENDIX C
DRILLING SPECIFICATIONS

APPENDIX C. DRILLING SPECIFICATIONS

An M&E representative shall oversee all drilling activities. The drilling subcontractor is asked to provide the drilling, soil sampling and well installation costs based on the itemized list included in this document. Additional borings/wells may be installed using the driller's unit costs if field data indicates a need for additional monitoring points/samples.

LOCATION, ACCESS, AND SITE CONDITIONS

The work performed shall take place at an inactive facility in Granville, Ohio. The facility is currently involved in a CERCLA action.

Metcalf and Eddy, prior to the commencement of drilling operations, shall clear drilling locations. Electric service and water will be available at the site.

PERSONNEL

On-site personnel covered by this scope of work will satisfy the training and monitoring requirements for hazardous site work in accordance with OSHA 29 CFR 1910.120. Documentation of training and monitoring requirements is the responsibility of each employer. Contractor is responsible for providing M&E with a copy of their site-specific Health & Safety Plan prior to the commencement of the work. M&E shall review the Plan for compliance with the contract terms and conditions only. Contractor shall be required to review the M&E site-specific Health & Safety Plan and agree to comply with the limitations therein during the execution of this work.

DRILLING AND WELL CONSTRUCTION

It is estimated that 26 borings/wells will be installed to three distinctly different depth ranges below grade. The number of wells and the approximate depths are fourteen wells to ten feet, six

wells to 20 feet and six wells to 45 feet. Figures 1,2 and 3 illustrate the subsurface portions of each boring/well. Costs to drill the borings/wells shall be on a unit cost basis and entered on the bid sheet enclosed. Each boring may be sampled at the discretion of M&E personnel with 3-inch split spoon samplers to verify lithology.

The contractor shall mobilize a minimum of one hundred and twenty feet of augers including four lead augers. In some instances decontamination procedures will be waived between borings at the direction of the site geologist.

Unit prices shall be provided for each of the following:

- Mobilization to the site in Granville Ohio.
- Decon pad construction, maintenance and demolition including placement of waste materials in the roll-off soil container and waste water into drums or a polyethylene tank supplied by M&E.

- Hollow stem auger drilling per foot, 4 ¼ ID augers.
  Fourteen wells to ten feet (140 feet).Figure 1.
  Six wells to 20 feet (120 feet). Figure 2.
  Six wells to 45 feet (270 feet). Figure 3.
- Bentonite grout placed with tremmie pipe placed into six 1-inch wells forty feet per well.(240 linear annular feet)(Figure 3).
- Split spoon sampling per sample. Three-inch sampler. Quantity and depth to be determined in the field to verify lithology.
- Well construction time per hour.
- PVC well casing, 2-inch diameter, per linear foot. (130 feet, ten foot sections)
- PVC well screen, 2-inch diameter, **0.020 slot**, (14 five foot sections and 6 ten foot sections).
- PVC well top and bottom cap 2-inch diameter non threaded (Forty required)..
- PVC well casing, 1inch diameter, per linear foot (280 feet required).
- PVC well screen, 1-inch diameter, **0.020 slot**, per five foot section (Three required).

- PVC well top and bottom cap, 1-inch diameter non threaded (twelve required).
- Silica sand, #4, per sack. (168 linear, annular feet)
- Bentonite well seal material in 3/8 inch granular form, per bag (170 linear, annular feet).
- Bentonite well seal powder in granular form, per bag, three bags.
- Decontamination time, per hour.
- Well construction time, per hour.
- Standby time, per hour.

Well Installation Procedures

Once the targeted drilling depth has been reached, the driller shall confirm the total depth of each boring using a clean, weighted tape measure. The M&E representative shall approve this depth before installing well materials into the borehole.

Each monitoring well will be constructed with the specified screen and riser as shown in Figures 1, 2 and 3.included in this document. Washed silica sand and bentonite shall be placed at the bottom of the boring and around the monitoring well. During the placement of sand, the level of sand shall be frequently checked with a clean, weighted tape measure to ensure that the sand has not bridged in the well bore. A bentonite seal shall be installed with a minimum thickness of one-foot above the sandpack. The seal shall consist of bentonite pellets with a small quantity of granular bentonite placed within and above the chips (not shown on figures) to facilitate rapid hydration. After the bentonite seal has been placed, five gallons of potable water shall be added to hydrate the pellets and create an effective seal. After the seal has had an appropriate time to set, the remaining annulus shall be filled as noted with bentonite chips or pumped grout. Grout material will be extended to within 2-feet of surface grade.

Each well will receive no final finish work from the drilling subcontractor. The well casing will be cut off approximately two feet above grade and covered with a slip cap. The drilling

subcontractor will wear clean latex gloves when handling and assembling well materials. All well materials are to be new and arrive on-site in the factory packaging.

The M&E representative will inspect materials prior to well assembly. M&E reserves the right to reject any unsuitable materials or to require that they be steam-cleaned prior to use.

DECONTAMINATION OF DRILLING EQUIPMENT

The driller, prior to use at each sampling interval, will decontaminate split spoons by scrubbing them with a non-phosphate soap and tap water and followed by a rinse with distilled water. Prior to and following their use at each location, all augers, rods and down-hole tooling will be steam-cleaned. This procedure may be waived in the event that the M&E site personnel determines that it will not be necessary.

Steam cleaning will take place on a temporary decontamination pad constructed by the driller. The pad will allow for the containerization of all water produced by the decontamination procedures. Decon water will be collected and placed into a polyethylene tank provided by M&E. All soil cuttings will be containerized in a roll-off container supplied by M&E. Transportation of soils to the roll-off container will be the responsibility of the drilling subcontractor. A line item for the decon pad shall be provided by the drilling subcontractor.

PERSONNEL PROTECTIVE EQUIPMENT (PPE)

Real time air monitoring will be conducted by M&E personnel during intrusive drilling activities. If Action Levels for breathing zone concentrations of organic vapors are exceeded, as set forth in the M&E Health & Safety Plan, an upgrade to Level C PPE may take place prior to the continuation of work. The subcontractor is to provide a per hour surcharge that is inclusive of all associated costs for Level C work. It is anticipated that all work can be accomplished in Level D (hard hat, safety glasses, steel toe boots, work clothes and proper hand protection).

COST ESTIMATE USING HOLLOW-STEM AUGER DRILLING

ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
Mobilization/Demobilization	One	1		
Decon pad construction, maintenance and demolition	One	1		
Hollow Stem Auger Drilling, per foot, Using 4-1/4 ID augers	14 wells to 10 ft (140 ft)	Foot		
Hollow Stem Auger Drilling, per foot, Using 4-1/4 ID augers	6 wells to 20 ft (120 ft)	Foot		
Hollow Stem Auger Drilling, per foot, Using 4-1/4 ID augers	6 wells to 45 ft (270 ft)	Foot		
Bentonite Grout w/ Tremmie Pipe	6-1 in. wells 40 ft each (240 linear feet.)	Foot		
Split Spoon Sampling (per sample)	3" sampler; quantity & depth TBD	Sample		
Well Construction Time	Per hour	Hour		
PVC Well Casing	2" dia; per lin ft; (130 ft; 10 ft sec)	Foot		
PVC Well Screen	2" dia; **0.020** slot; 130 feet,13-10 ft sections	Foot		
PVC Well Top and Bottom Cap	2" dia. non-threaded (40 required)	Each		
PVC Well Casing	1" dia., per linear ft (280 ft required)	Foot		
PVC Well Screen	1" dia; **0.020** slot; per 5' sec (3 required)	Foot		
PVC Well Top and Bottom Cap	1" dia. non-threaded (12 required)	Each		
Silica Sand	#4, per sack (168 lin. ann. ft)	Bag		
Bentonite Well Seal Material	Fine granular form Three bags.	Bag		
Bentonite Well Seal Material	3/8" granular form, (170 linear feet)	Bag		
Decontamination Time	Per hour	Hour		
Bobcat or other soil moving machinery	Per day	Day		
Standby Time	Per hour	Hour		

APPENDIX D
DISCUSSION OF THE USE OF PHOTOIONIZATION DETECTOR FOR MONITORING AIR EMISSIONS

APPENDIX D. DISCUSSION OF THE USE OF PHOTOIONIZATION DETECTOR FOR MONITORING AIR EMISSIONS

Photoionization detectors (PIDs) are useful to monitor emissions from the treatment system. The results obtained from these instruments, particularly an instrument using a lamp with and energy of 10.2 eV, do not accurately measure the cumulative volatile organic compound (VOC) concentration of all of the chemicals of concern that may be present. This is a direct result of the ionization potential of each individual VOC and the relative mix with other VOC's.

After a brief period of operation of an SVE system, one generally expects that the relative mix of VOC's in the air removed from the soil is relatively stable over relatively long periods of time. When correlated with more accurate methods, such as the results obtained using standard methods TO-14/TO-15, the results from a PID may be used to document changes in overall emission concentrations and estimate the amount of chemical mass discharged in a relatively accurate manner.

The analytical results of samples collected from the discharge of the SVE system will be conducted on a periodic basis (Table 2, Section 5). These data will be used to develop a correlation with the PID readings collected more frequently. Estimates of air discharge will be made on a monthly basis and reported in the quarterly reports to keep the regulatory community and interested parties apprised of the emission rates.

During the sand unit SVE test, PID readings were recorded and a single sample was collected and analyzed using methods TO-14/TO-15. The reading of the PID was 75 ppmV while the system was operated at a maximum flow rate of 125 scfm. The TO-14/TO-14 results are attached below for your use.

Report of Analysis

Client Sample ID:	MW-8		
Lab Sample ID:	E71877-1	**Date Sampled:**	06/23/00
Matrix:	AIR - Air	**Date Received:**	06/26/00
Method:	TO-14/TO-15	**Percent Solids:**	n/a
Project:	Granville Solvents		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	Q9046.D	1	06/26/00	WG	n/a	n/a	VQ356
Run #2	Q9047.D	20	06/26/00	WG	n/a	n/a	VQ356
Run #3	Q9049.D	320	06/27/00	WG	n/a	n/a	VQ356

CAS No.	MW	Compound	Result	RL	Units	Q	Result	RL	Units
71-43-2	78	Benzene	1.5	0.20	ppbv		4.8	0.64	ug/m3
74-83-9	94	Bromomethane	ND	0.20	ppbv		ND	0.77	ug/m3
108-90-7	112	Chlorobenzene	ND	0.20	ppbv		ND	0.92	ug/m3
75-00-3	64	Chloroethane	ND	0.20	ppbv		ND	0.52	ug/m3
67-66-3	118	Chloroform	4.2	0.20	ppbv		20	0.96	ug/m3
74-87-3	50	Chloromethane	ND	0.20	ppbv		ND	0.41	ug/m3
56-23-5	152	Carbon tetrachloride	1.7	0.20	ppbv		10	1.2	ug/m3
75-34-3	98	1,1-Dichloroethane	48.5 [b]	4.0	ppbv		194 [b]	16	ug/m3
75-35-4	96	1,1-Dichloroethylene	86.2 [b]	4.0	ppbv		338 [b]	16	ug/m3
106-93-4	186	1,2-Dibromoethane	ND	0.20	ppbv		ND	1.5	ug/m3
107-06-2	98	1,2-Dichloroethane	ND	0.20	ppbv		ND	0.80	ug/m3
78-87-5	112	1,2-Dichloropropane	ND	0.20	ppbv		ND	0.92	ug/m3
75-71-8	120	Dichlorodifluoromethane	0.17	0.20	ppbv	J	0.83	0.98	ug/m3
156-60-5	96	trans-1,2-Dichloroethylene	7.5	0.20	ppbv		29	0.78	ug/m3
156-59-2	96	cis-1,2-Dichloroethylene	322 [b]	4.0	ppbv		1260 [b]	16	ug/m3
10061-01-5	110	cis-1,3-Dichloropropene	ND	0.20	ppbv		ND	0.90	ug/m3
541-73-1	146	m-Dichlorobenzene	ND	0.20	ppbv		ND	1.2	ug/m3
95-50-1	146	o-Dichlorobenzene	ND	0.20	ppbv		ND	1.2	ug/m3
106-46-7	146	p-Dichlorobenzene	1.4	0.20	ppbv		8.4	1.2	ug/m3
10061-02-6	110	trans-1,3-Dichloropropene	ND	0.20	ppbv		ND	0.90	ug/m3
100-41-4	106	Ethylbenzene	1.5	0.20	ppbv		6.5	0.87	ug/m3
622-96-8	120.2	4-Ethyltoluene	0.59	0.20	ppbv		2.9	0.98	ug/m3
76-13-1	186	Freon 113	8.0	0.20	ppbv		61	1.5	ug/m3
76-14-2	170	Freon 114	ND	0.20	ppbv		ND	1.4	ug/m3
87-68-3	261	Hexachlorobutadiene	ND	0.20	ppbv		ND	2.1	ug/m3
75-09-2	84	Methylene chloride	0.71	0.20	ppbv		2.4	0.69	ug/m3
1634-04-4	88	Methyl Tert Butyl Ether	ND	0.20	ppbv		ND	0.72	ug/m3
100-42-5	104	Styrene	1.4	0.20	ppbv		6.0	0.85	ug/m3
71-55-6	132	1,1,1-Trichloroethane	ND	0.20	ppbv		ND	1.1	ug/m3
71-55-6	132	1,1,1-Trichloroethane	6770 [c]	64	ppbv		36500 [c]	340	ug/m3
79-34-5	166	1,1,2,2-Tetrachloroethane	ND	0.20	ppbv		ND	1.4	ug/m3
79-00-5	132	1,1,2-Trichloroethane	ND	0.20	ppbv		ND	1.1	ug/m3
120-82-1	181	1,2,4-Trichlorobenzene	ND	0.20	ppbv		ND	1.5	ug/m3
95-63-6	120	1,2,4-Trimethylbenzene	2.5	0.20	ppbv		12	0.98	ug/m3
108-67-8	120	1,3,5-Trimethylbenzene	0.70	0.20	ppbv		3.4	0.98	ug/m3

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	MW-8		
Lab Sample ID:	E71877-1	**Date Sampled:**	06/23/00
Matrix:	AIR - Air	**Date Received:**	06/26/00
Method:	TO-14/TO-15	**Percent Solids:**	n/a
Project:	Granville Solvents		

CAS No.	MW	Compound	Result	RL	Units	Q	Result	RL	Units
127-18-4	164	Tetrachloroethylene	36.3	0.20	ppbv		243	1.3	ug/m3
108-88-3	92	Toluene	5.3	0.20	ppbv		20	0.75	ug/m3
79-01-6	130	Trichloroethylene	2100 [c]	64	ppbv		11200 [c]	340	ug/m3
75-69-4	136	Trichlorofluoromethane	36.2 [b]	4.0	ppbv		201 [b]	22	ug/m3
75-01-4	62	Vinyl chloride	0.35	0.20	ppbv		0.89	0.51	ug/m3
	106	m,p-Xylene	4.6	0.20	ppbv		20	0.87	ug/m3
95-47-6	106	o-Xylene	1.9	0.20	ppbv		8.2	0.87	ug/m3
1330-20-7	106	Xylenes (total)	6.4	0.20	ppbv		28	0.87	ug/m3

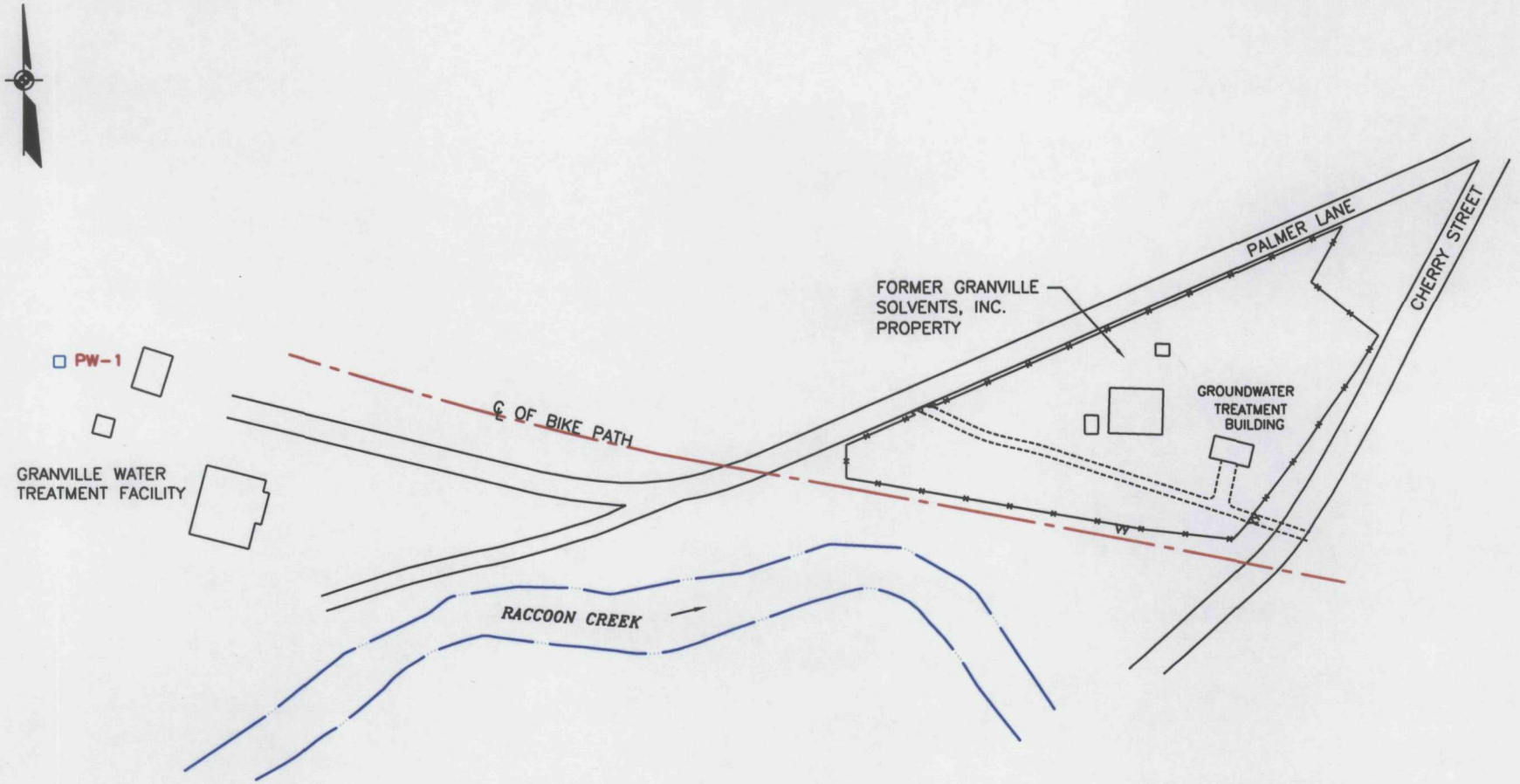
CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Run# 3	Limits
460-00-4	4-Bromofluorobenzene	103%	101%	97%	70-130%

(a) Total Volatiles calculated as equivalent 1,1,1-Trichloroethane is 24900ppbv or 134000ug/m3.
(b) Result is from Run# 2
(c) Result is from Run# 3

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

APPENDIX E

FIGURES



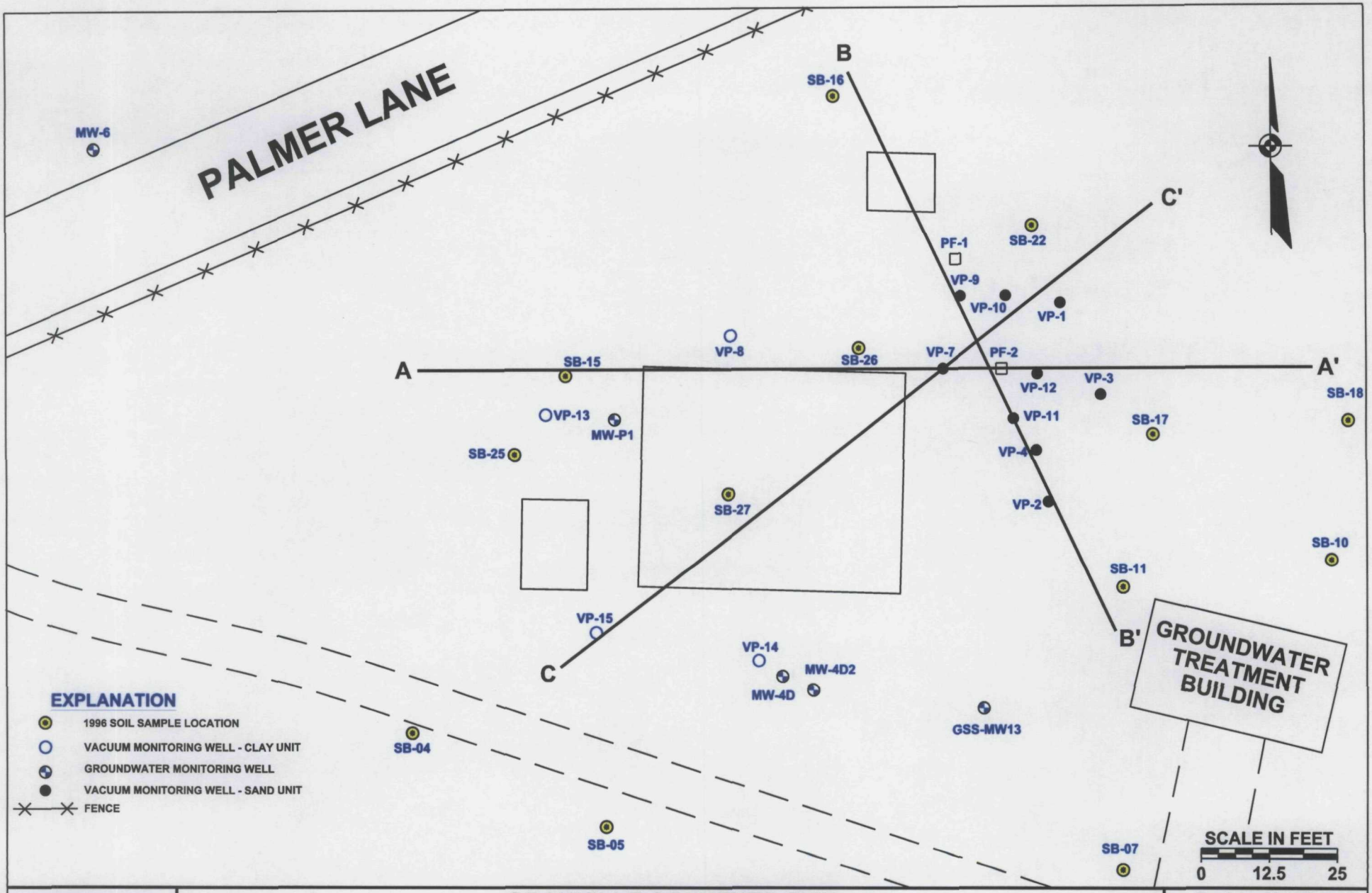
Metcalf & Eddy

GRANVILLE SOLVENTS SITE

SITE LOCATION MAP

GRANVILLE, OHIO

Project Number	
036100178.0001.00191	
File Name	Figure
100178-SLM	1



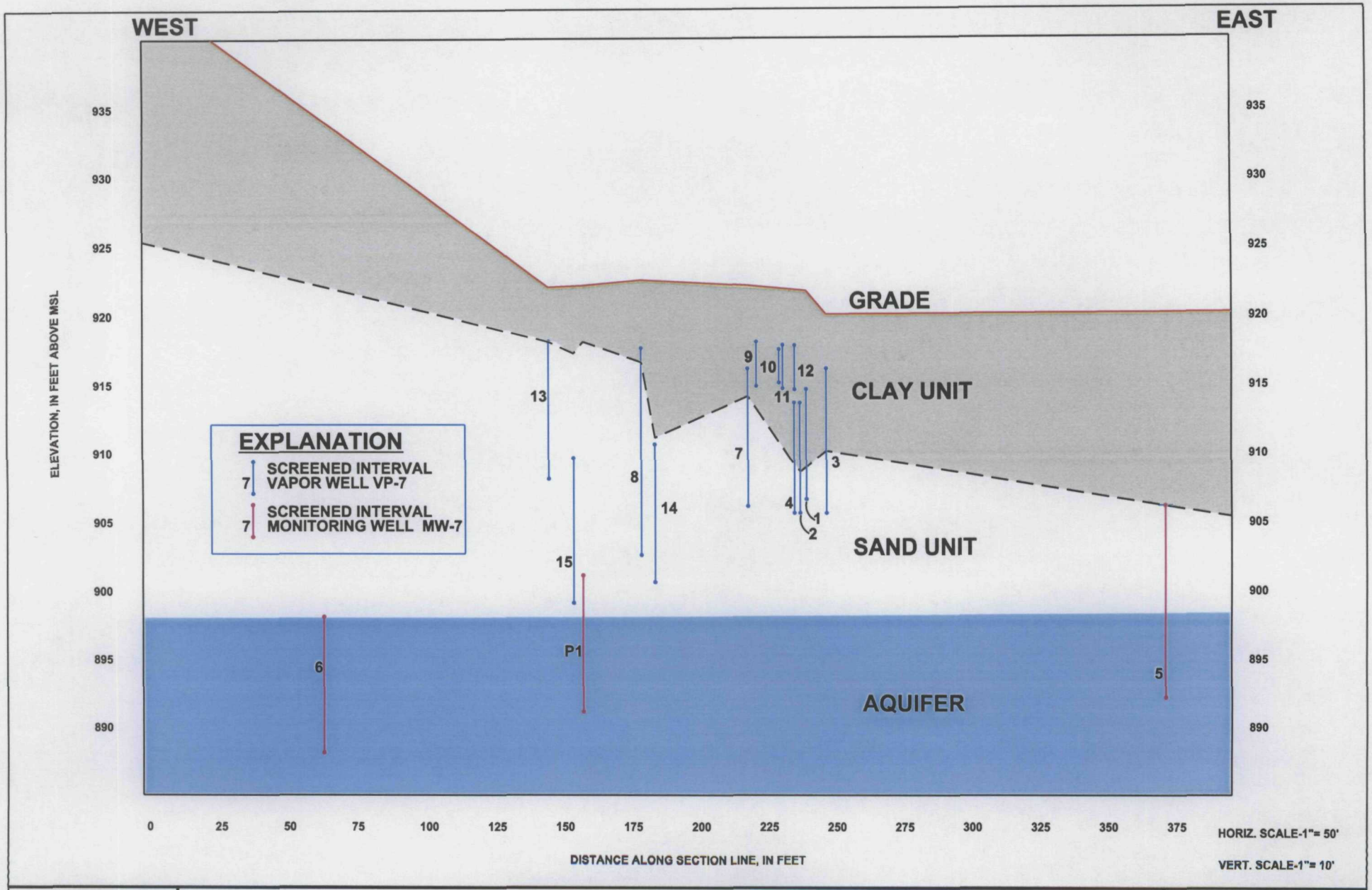
Metcalf & Eddy

GRANVILLE SOLVENTS SITE

CROSS SECTION LOCATION MAP

GRANVILLE, OHIO

Project Number	
036100178.0001.00191	
File Name	Figure
100178FIG2	2



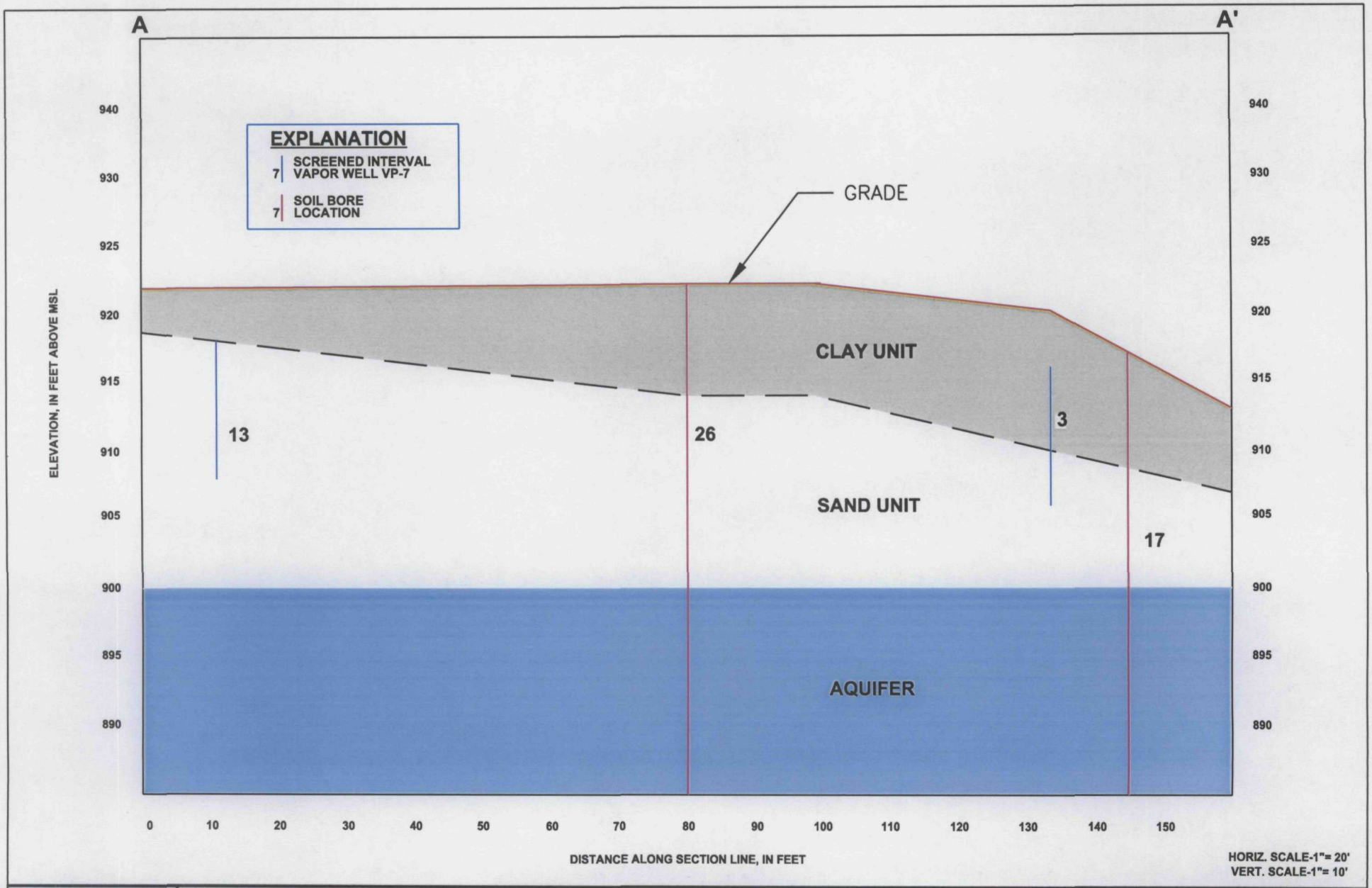
Metcalf & Eddy

GRANVILLE SOLVENTS SITE

SCREEN INTERVALS FOR VAPOR WELLS MONITORING WELLS FROM PILOT TEST

GRANVILLE, OHIO

Project Number	
036100178.0001.00191	
File Name	Figure
100178FIG3	3



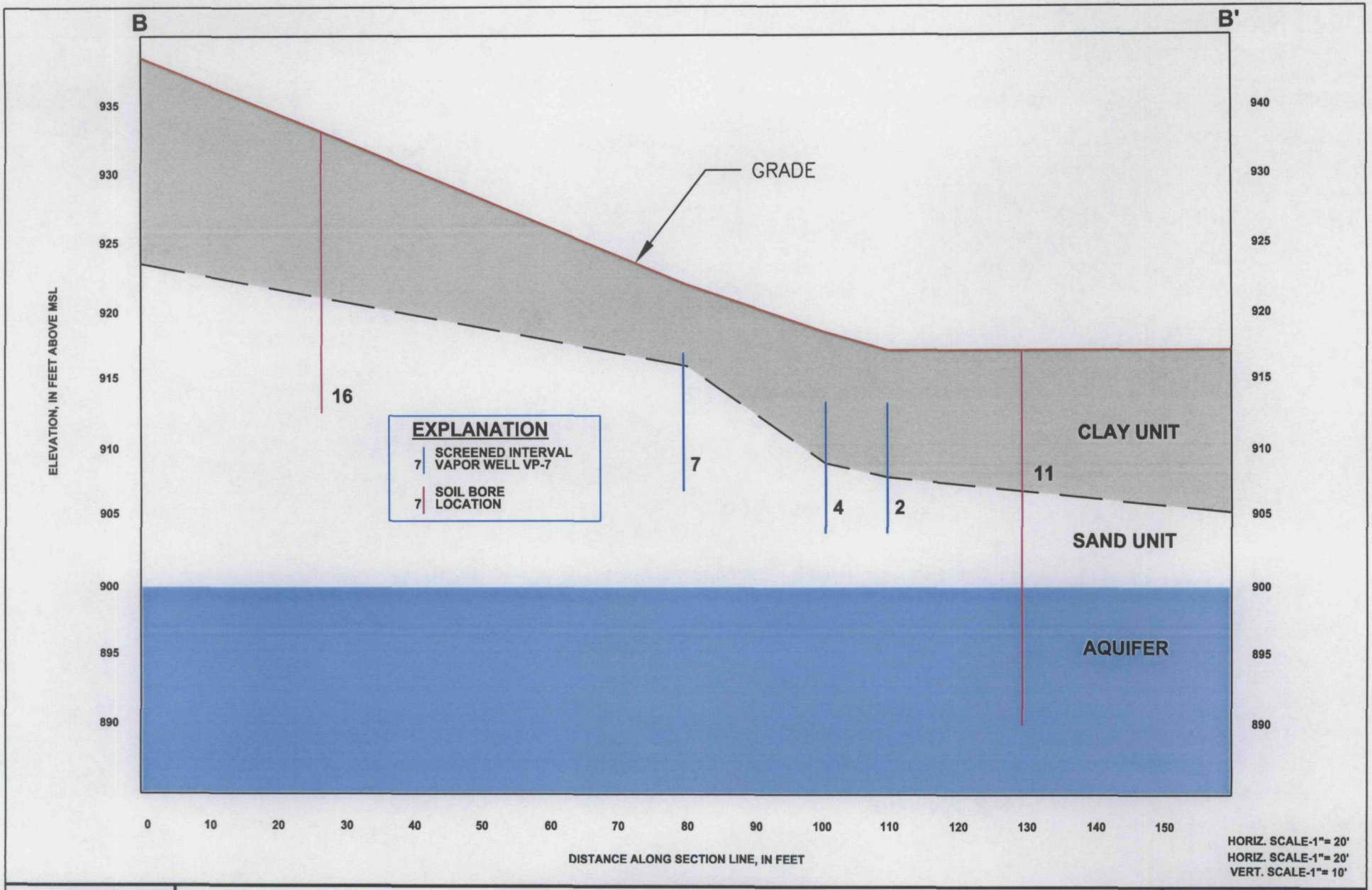
Metcalf & Eddy

GRANVILLE SOLVENTS SITE

CROSS SECTION A-A'

GRANVILLE, OHIO

Project Number	
036100178.0001.00191	
File Name	Figure
100178-A-A'	4



Metcalf & Eddy

GRANVILLE SOLVENTS SITE

CROSS SECTION B-B'

GRANVILLE, OHIO

Project Number	
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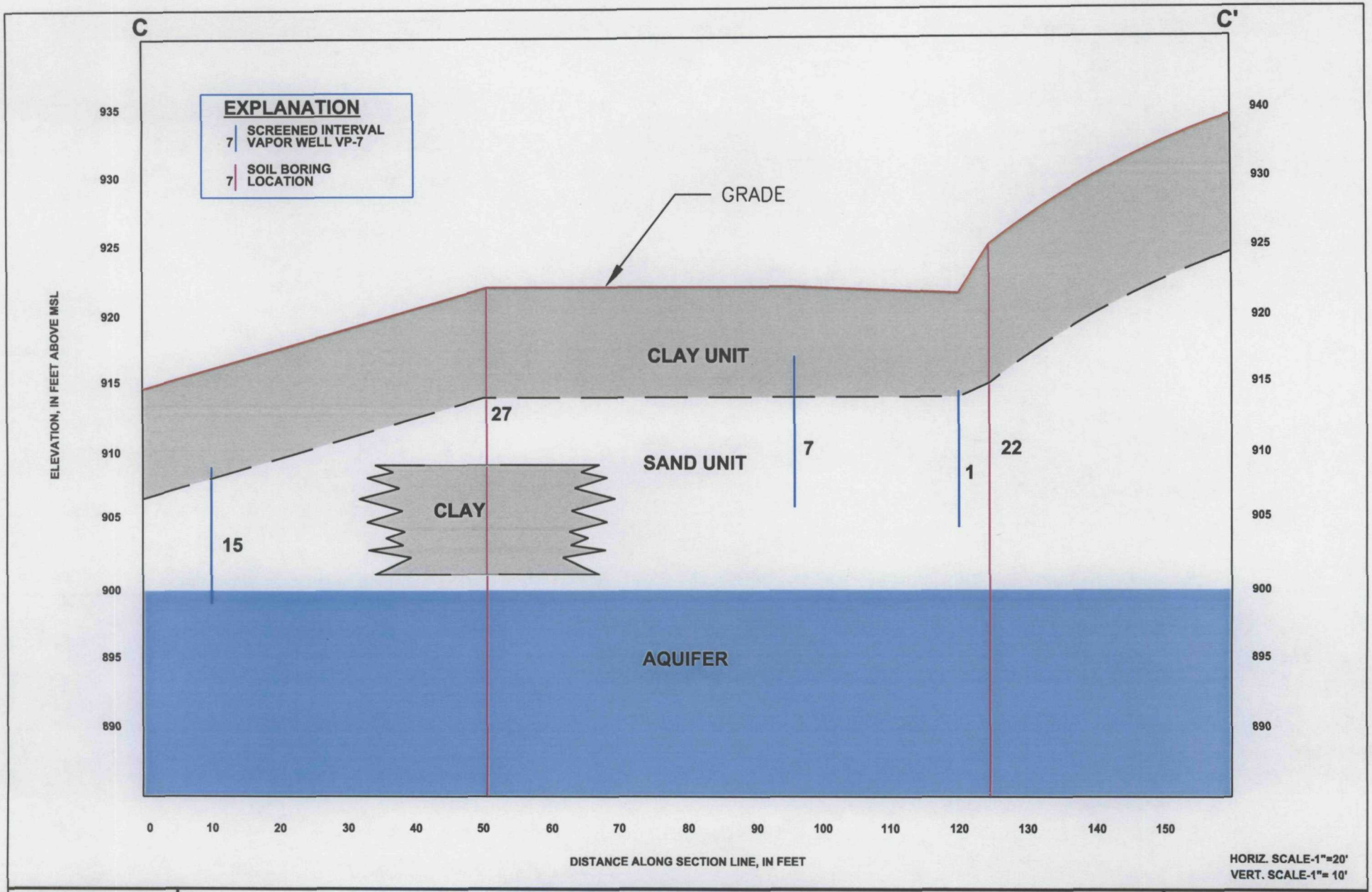
File Name	Figure
100178-B-B'	5



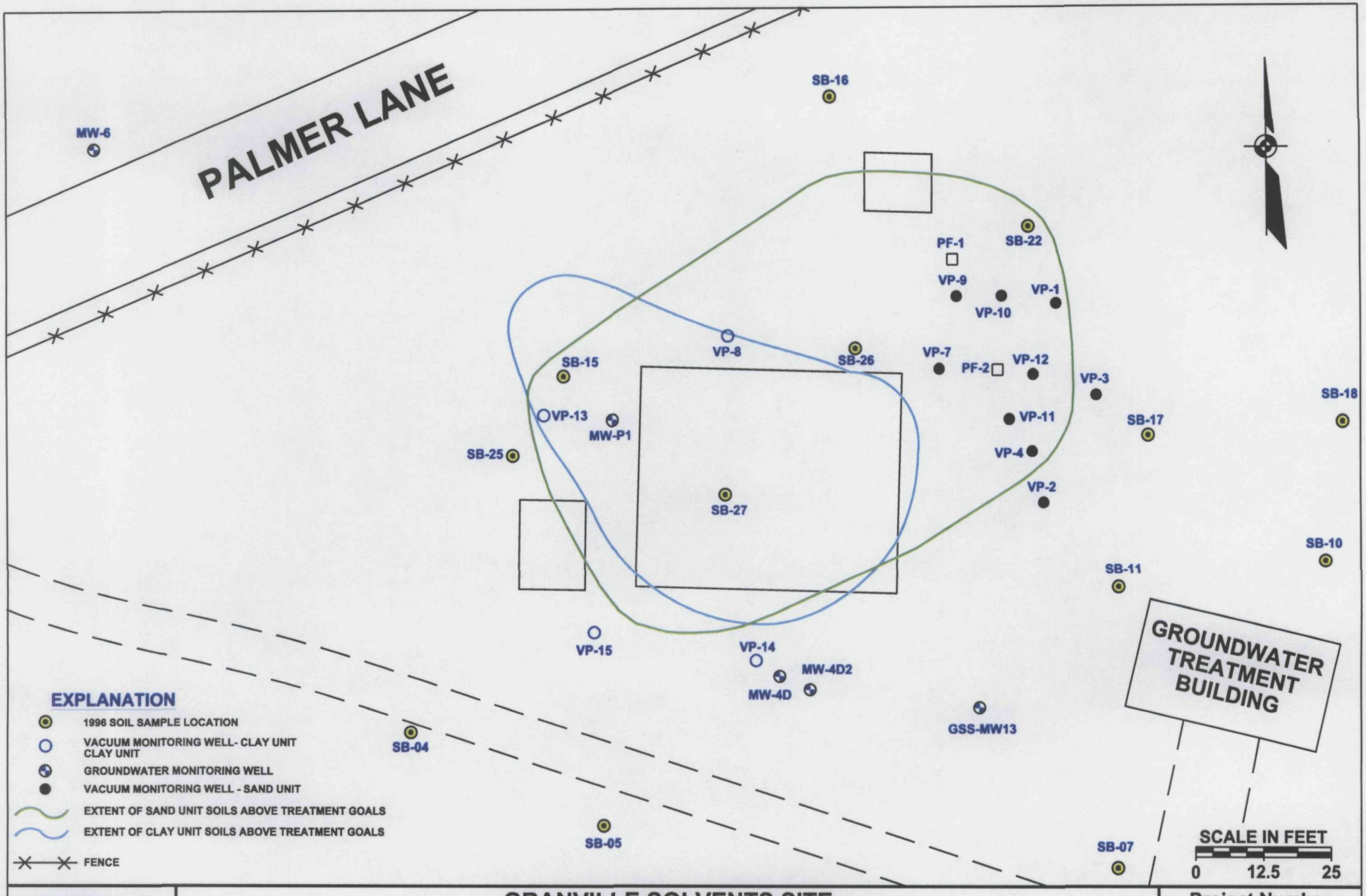
Metcalf & Eddy

GRANVILLE SOLVENTS SITE

CROSS SECTION C-C'

GRANVILLE, OHIO

Project Number	
036100178.0001.00191	
File Name	Figure
100178-C-C'	6



Metcalf & Eddy

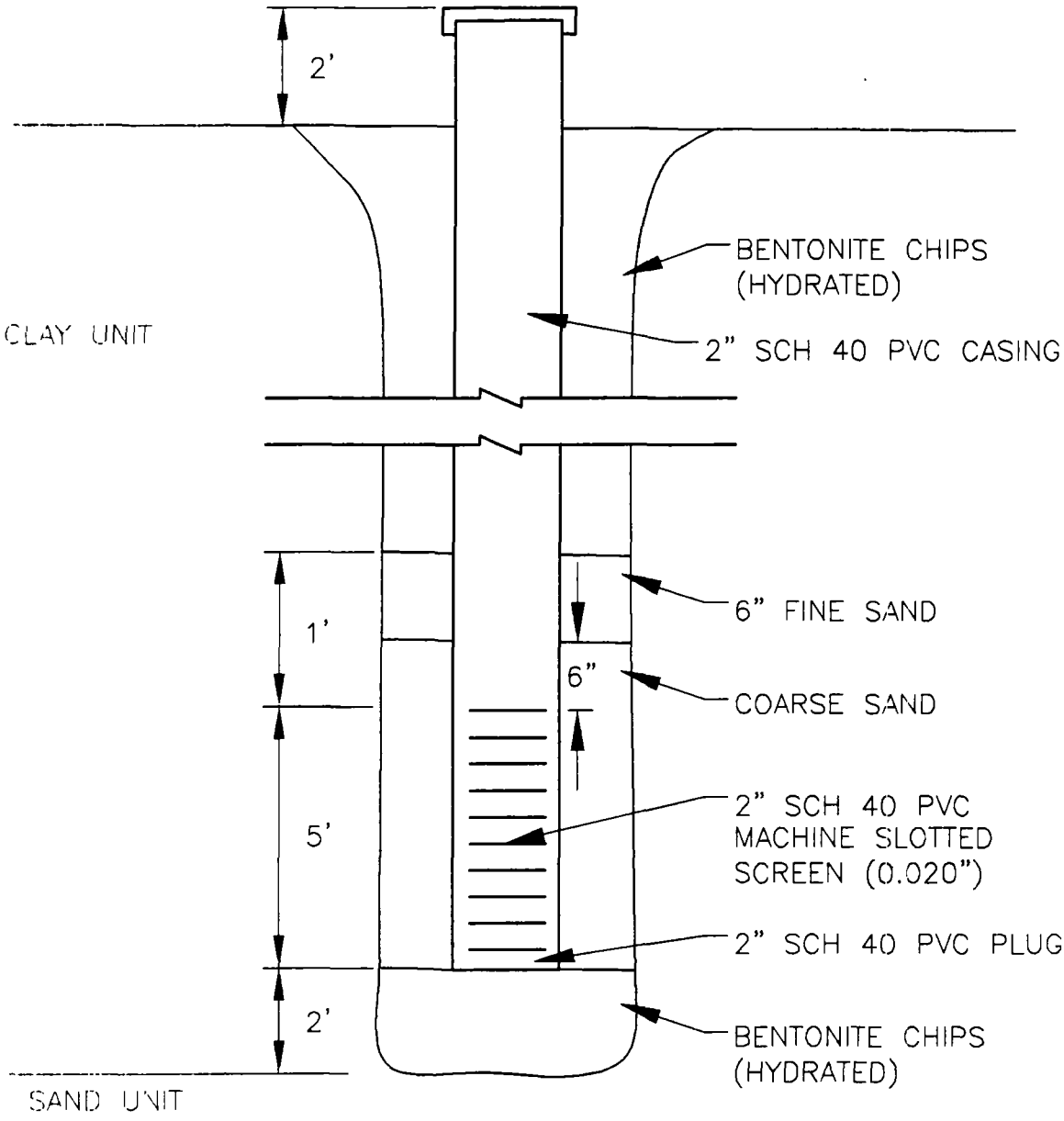
GRANVILLE SOLVENTS SITE

SOIL TREATMENT AREAS

GRANVILLE, OHIO

Project Number	
036100178.0001.00191	
File Name	Figure
100178-FIG7	7

ATTACHMENTS



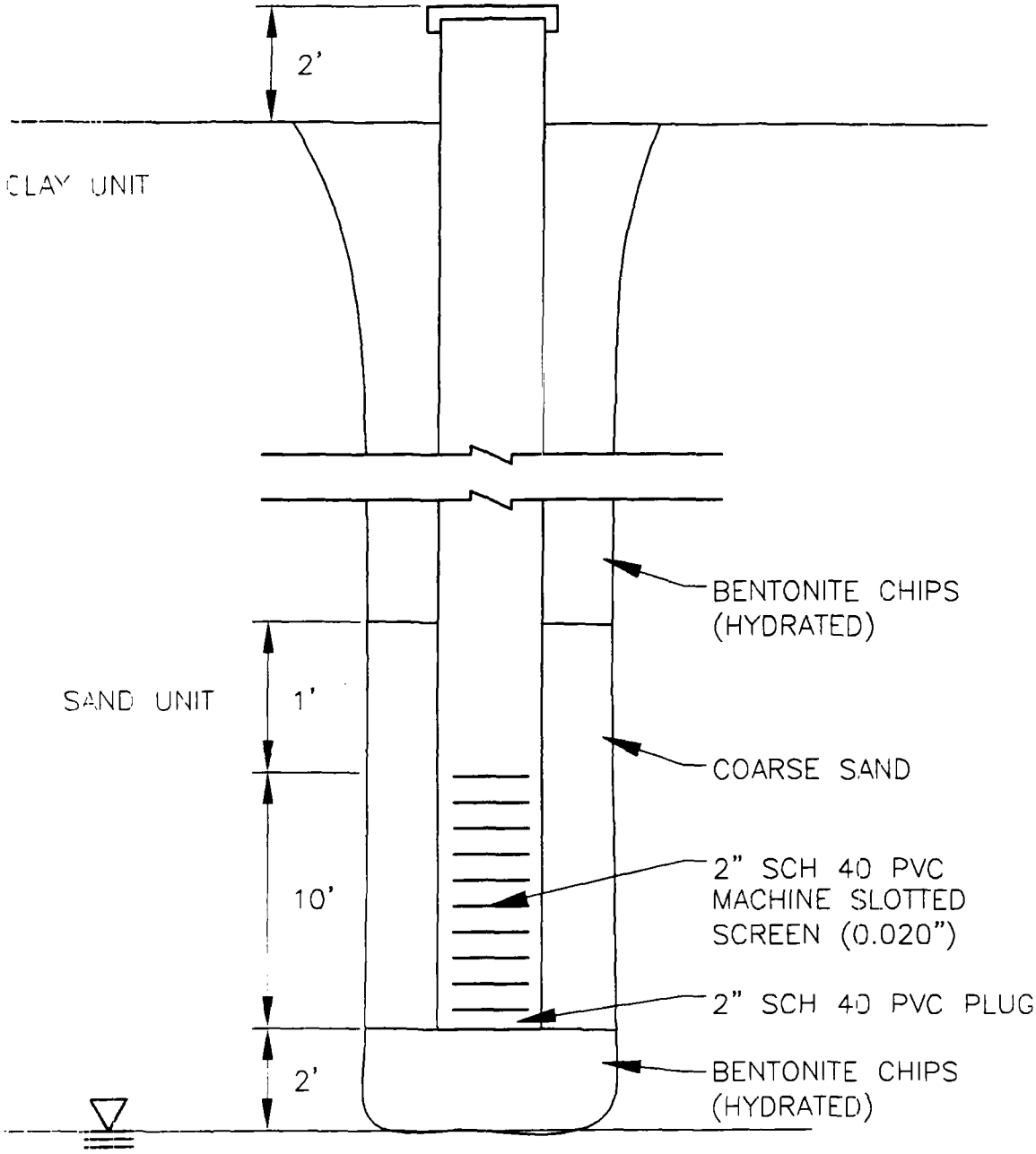
AIR INJECTION WELL
14 @ ≈ 10' TD*

NOT TO SCALE

*TOTAL DEPTH TO BE DETERMINED IN THE FIELD AS DIRECTED BY M&E

NOT TO SCALE

Metcalf & Eddy	GRANVILLE SOLVENTS SITE SVE INSTALLATION DRILLING SCOPE OF WORK WELL DETAILS GRANVILLE, OHIO	Project Number 025508 File Name 025508WELLDETAIL / Figure 1



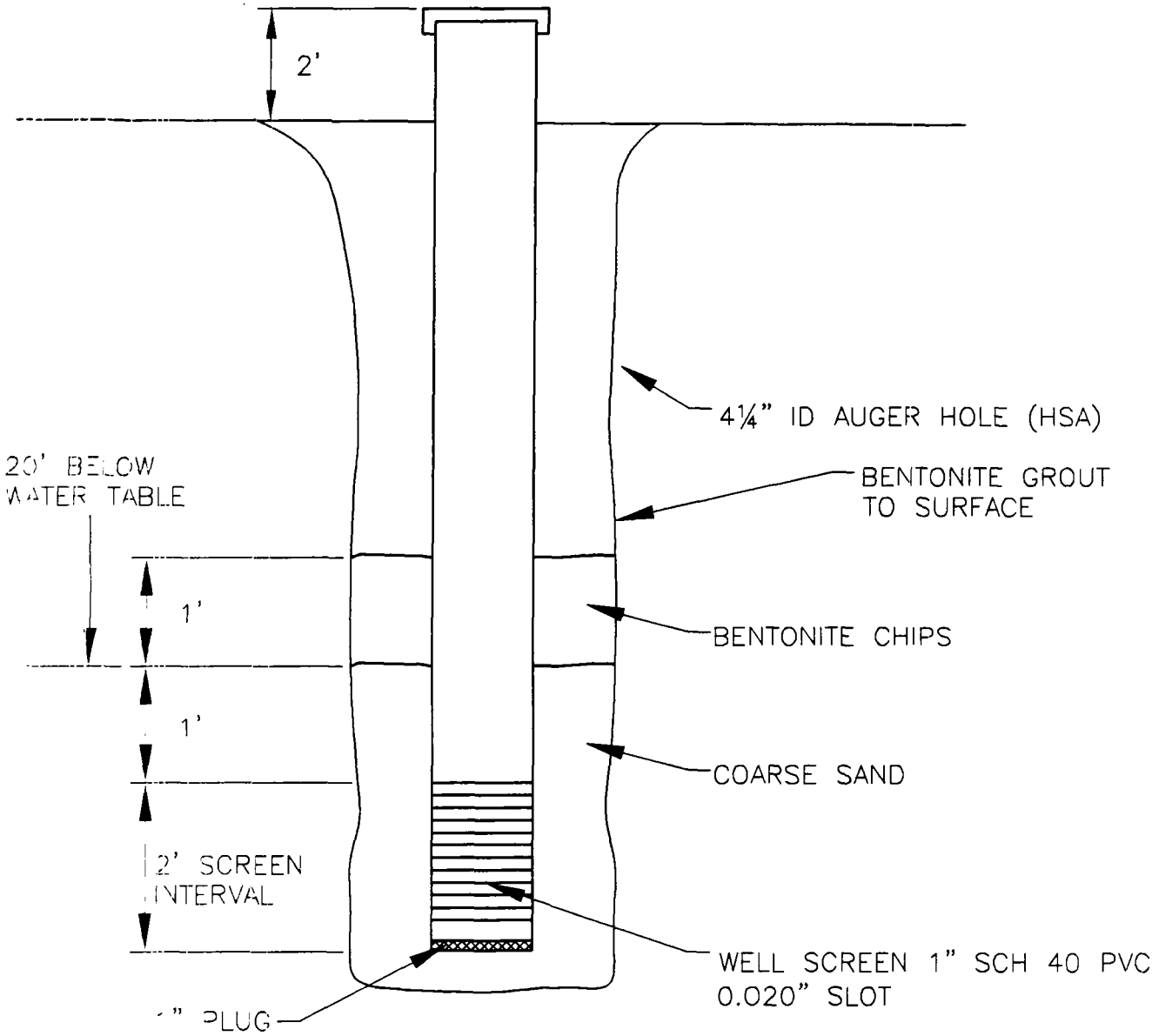
VACUUM EXTRACTION WELL
6 @ ≈ 20' TD*

NOT TO SCALE

*TOTAL DEPTH TO BE DETERMINED IN THE FIELD AS DIRECTED BY M&E

NOT TO SCALE

M&E Metcalf & Eddy	GRANVILLE SOLVENTS SITE SVE INSTALLATION DRILLING SCOPE OF WORK WELL DETAILS GRANVILLE, OHIO	Project Number 025508 File Name 025508WELLDETAIL / Figure 2



AIR SPARGING WELL
6 @≈45' TD*

NOT TO SCALE

*TOTAL DEPTH TO BE DETERMINED IN THE FIELD AS DIRECTED BY M&E

NOT TO SCALE

Metcalf & Eddy	GRANVILLE SOLVENTS SITE SVE INSTALLATION DRILLING SCOPE OF WORK WELL DETAILS GRANVILLE, OHIO	Project Number 025508 File Name 025508WELLDETAIL | Figure 3

APPENDIX F

SCHEDULE

Granville Solvents Site
Removal Action
for the
Treatment of Impacted Soil
SCHEDULE

ID	Task Name	Duration
1	Solicit Subcontractor Bids	28 days
4	Procure Subcontractor Services	21 days
7	Mechanical System Buildout	89 days
8	Sampling & Analysis Plan	14 days
9	Construction Management	114 days
10	D&D Blds & Slabs	21 days
14	Install AI, SVE, and AS Systems	63 days
20	Startup	91 days
24	OM&M Plan	14 days
25	Exit Strategy	60 days